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CHEMETALS

October 26, 1990

Public Docket A-90-16
Air Docket (LE-131)
EPA 401 M. Street SW
Room M-1500
Washington, D.C. 20460

RECEIVED
OCT 29 1990

Dear Sir/Madam:

Chemetals has submitted comments on the waiver request of Ethyl Corporation for the use of HiTEC 3000 in unleaded gasoline in the United States.

Recently, Dr. Robert W. Hart of BHP, Ltd. has completed the analysis of a new study of workers exposed to manganese dioxide dust.

Find attached a copy of Dr. Hart's preliminary report which clearly states that low levels of manganese exposure do not result in any adverse health effect, especially neuropsychological effects.

Very truly yours,



Dr. Francis J. Keenan
Vice President - Technology

enclosures

cc: Mary T. Smith
Director-Field Operations
and Support Division
(EN0397F)

FJK/mrt

25th October 1990

Mr. David J. Kortum
Mail Code EN-397F
U.S. Environmental Protection Agency
Fairchild Building (3rd Floor)
499 South Capital Street
Washington, D.C. 20003

Dear Mr. Kortum

Thank you for your facsimile of 18th September regarding the BHP study on low level exposure to manganese dust. I apologise for not being able to answer earlier but your facsimile arrived after I had already departed on an overseas trip.

A report of the preliminary analysis was discussed by the Steering Committee on the 7th of September and an interim report given verbally to the workforce on Groote Eylandt in the second week of September. Statistical analysis is continuing and therefore a report at this stage has not been publically released. A formal report will be subsequently made available and results submitted for publication in refereed scientific journals.

However, I can summarise some of the analysis provided by Professor A. Dobson, Professor of Biostatistics, Newcastle University, which primarily is a series of tables and requires an understanding of methodology. I am a little reluctant to forward a copy of the interim report but I also feel that you should be aware of our findings which may be helpful in your deliberations.

There were 302 participants from the exposed employees on Groote Eylandt and 147 from the control group from another remote north Australian opencut mining venture of which there is no manganese exposure. A questionnaire was administered which included the following :

1. job history
2. past exposure to neurotoxic materials (including solvents, heavy metals)
3. level of education
4. ethnicity
5. alcohol intake
6. smoking status
7. intake of tea, coffee, nuts
8. history of past illness and symptoms
9. current symptomatology including respiratory symptoms.

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In addition to historical data on dust exposure, each participant wore a personal sampler on the two days prior to venepuncture. Analysis on the first day was for inspirable dust (total) and on the second day for respirable dust.

Blood was collected for biochemistry, including liver function tests, and for haematology. Urine was also collected under strict conditions to avoid contamination and examined for manganese creatinine and calcium. Analyses were performed at the Prince of Wales hospital laboratories.

Neuropsychological tests performed were :

1. I.Q.
2. profile of mood states (bipolar)
3. paired associate learning
4. critical flicker fusion
5. REY auditory/verbal learning
6. hand/eye co-ordination
7. reaction time
8. tremorometry.

Dust Exposure

Sampling occurred over a period of eight hours and the ranges were :

- inspirable manganese range 0.00 - 0.47mg/m³, mean 0.05
- respirable manganese range 0.00 - 0.35mg/m³, mean 0.02

The dust monitoring programme had been validated by the National Occupational Health & Safety Commission prior to commencement of the study in September 1989.

The exposed group on Groote Eylandt were further subdivided into four groups based on historical exposure data, for within group comparisons. The mean exposures for the concentrator and the mining group were :

- inspirable manganese - concentrator 0.09mg/m³
- mining 0.04mg/m³
- respirable manganese - concentrator 0.03mg/m³
- mining 0.02mg/m³

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Summary of comparison between exposed and non-exposed groups

1. Neuropsychological tests showed no difference between the two groups.
2. The median values for blood and urinary manganese were in fact higher in the non-exposed group, as was urinary calcium and serum iron.
3. The prevalence of punctate basophilia (basophilic stippling of red cells) was significantly higher in the exposed group than the control group, as was the prevalence of macrocytosis. The means for haemoglobin levels, white cell counts and mean cell volumes were significantly lower for the exposed group than the control group.
4. Mean levels for blood sodium, potassium, CO₂ and bilirubin were significantly lower in the exposed group whilst triglyceride levels were higher. This may be due to problems with collection, preparation and transport and biochemical analysis in the first few weeks of the study.
5. Participants in the exposed group were significantly more likely to be Australian born and to have worked in their present section for a shorter period. Workers in the exposed group were working longer shifts and more hours per roster and had already worked longer on the day of testing.

Participants from the control group had more prior exposure to paints and varnishes and to working in dusty conditions. They reported higher prevalence of shortness of breath, eye and ear trouble, irritability, joint problems and arthritis, and glandular problems including goitre.

The major finding has been a higher prevalence of basophilic stippling of red cells amongst the exposed group. 76% of the exposed group demonstrated some degree of stippling compared to the control group of 52.4%.

99% of the control group had counts less than 1000 stipple cells per million red cells compared to the exposed groups of 99%. 4% of the exposed group had counts between 2000 and 3000 stipple cells per million red cells. This quantitative assessment of all blood slides involved the counting of 50 fields of 200 red cells. There were no counts greater than 3000 stipple cells per million red cells.

Statistical analysis has shown the incidence of stippling is highly correlated with abnormal liver function tests, most probably related to alcohol consumption. In addition to continuing statistical analysis, a further study to confirm and clarify the stippling involving re-sampling will occur during November.

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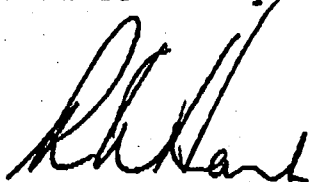
Punctate basophilia of red cells is a non-specific finding which has classically been associated in the past with lead intoxication. It also occurs in a variety of other conditions including pernicious anaemia, thalassemia, secondary anaemia and was reported amongst cement workers. Of importance is the fact that it can occur in healthy and unexposed individuals and Nelson in Australia in the 1940's demonstrated its presence in as high as 85% of apparently healthy and non-exposed indoor workers.

In documented cases of manganese intoxication where haematological investigation has occurred, there has been no abnormal punctate basophilia of red cells (Kesic and Hausler). These workers were exposed to levels of 7.5 to 63.3 mg/m³. It is therefore most unlikely that this is a manganese effect in our study where exposure is low level with a mean of 0.05mg/m³. If it were an effect it would be to postulate that manganese has a higher potential for causing this response than exposure to lead and we know this is not the case.

The primary thrust of our study was to determine if there were any adverse health effects and in particular of neuropsychological effects from exposure to low levels of manganese dioxide dust. These levels would of course be much higher than what could be expected environmentally from the release of the combustion products of MMT in petrol.

If I can be of further assistance please feel free to contact me by facsimile or phone when I would be pleased to discuss the findings further.

Yours sincerely,



R.W. HART
Director

References: Nelson, W.T. Medical Journal of Australia, 1931. 1 : 310 - 314.

Kesic, M.D. and Hausler, D.N. Archives Industrial Hygiene & Occupational Medicine, 1954. 10 : 336 - 342.

GROOTE EYLANDT MANGANESE STUDY**INTERIM REPORT - SUMMARY OF PRELIMINARY ANALYSIS**

The main results of the Groote Eylandt Manganese Study have been analysed. The aim of the study was to determine if there were any adverse health effects, especially neuropsychological effects, from working at the manganese mine on Groote Eylandt. Results of tests of 302 workers from Groote Eylandt have been compared to results applying the same tests to 147 workers mining iron ore on Koolan Island.

1. There were no significant differences between Groote Eylandt and Koolan Island for the neuropsychological tests or for other medical tests.
2. The results showed no significant differences between Groote Eylandt and Koolan Island for urine analysis. The results fell within normal limits for both populations.
3. Differences were found between Groote Eylandt and Koolan Island for biochemical tests, but these conditions are not related to manganese exposure. Where the blood analysis showed that a medical condition may exist, individuals have been notified.
4. Differences were found in one aspect of the blood examination between the two islands. Changes in red blood cells, known as basophilic stippling, which were more common on Groote Eylandt, do not appear to be related to manganese exposure and on average are mild. At this stage it is not known what is the cause of the change in the red cells or if it has been due to a sampling or transportation factor. The Steering Committee recommends that some further investigations be carried out to establish the cause of these changes.

Statistical analysis is continuing.

Manganese Study Steering Committee

Dr. Robert Hart (Chairman)

Emeritus Professor George Singer

Professor Annette Dobson

Associate Professor Michael Hensley

Dr Yossi Berger

17 September 1990